No. 665,891. Patented Jan. 15, 1901.

F. L. FETTY.

WINDMILL.

(Application filed May 31, 1900.)

(No Model.) 2 Sheets—Sheet 1.

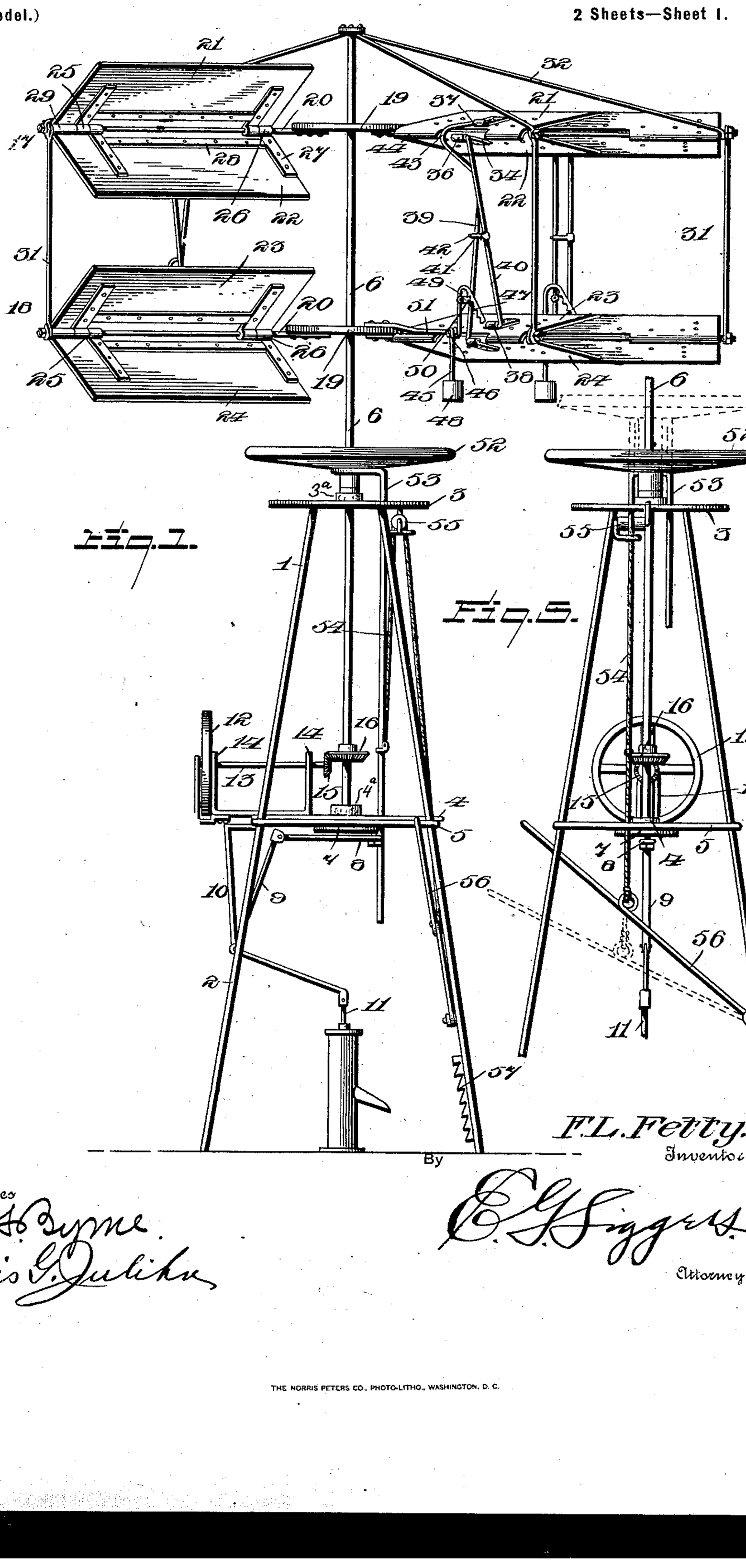

Fig. 1.

Fig. 5.

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Fig. 2.

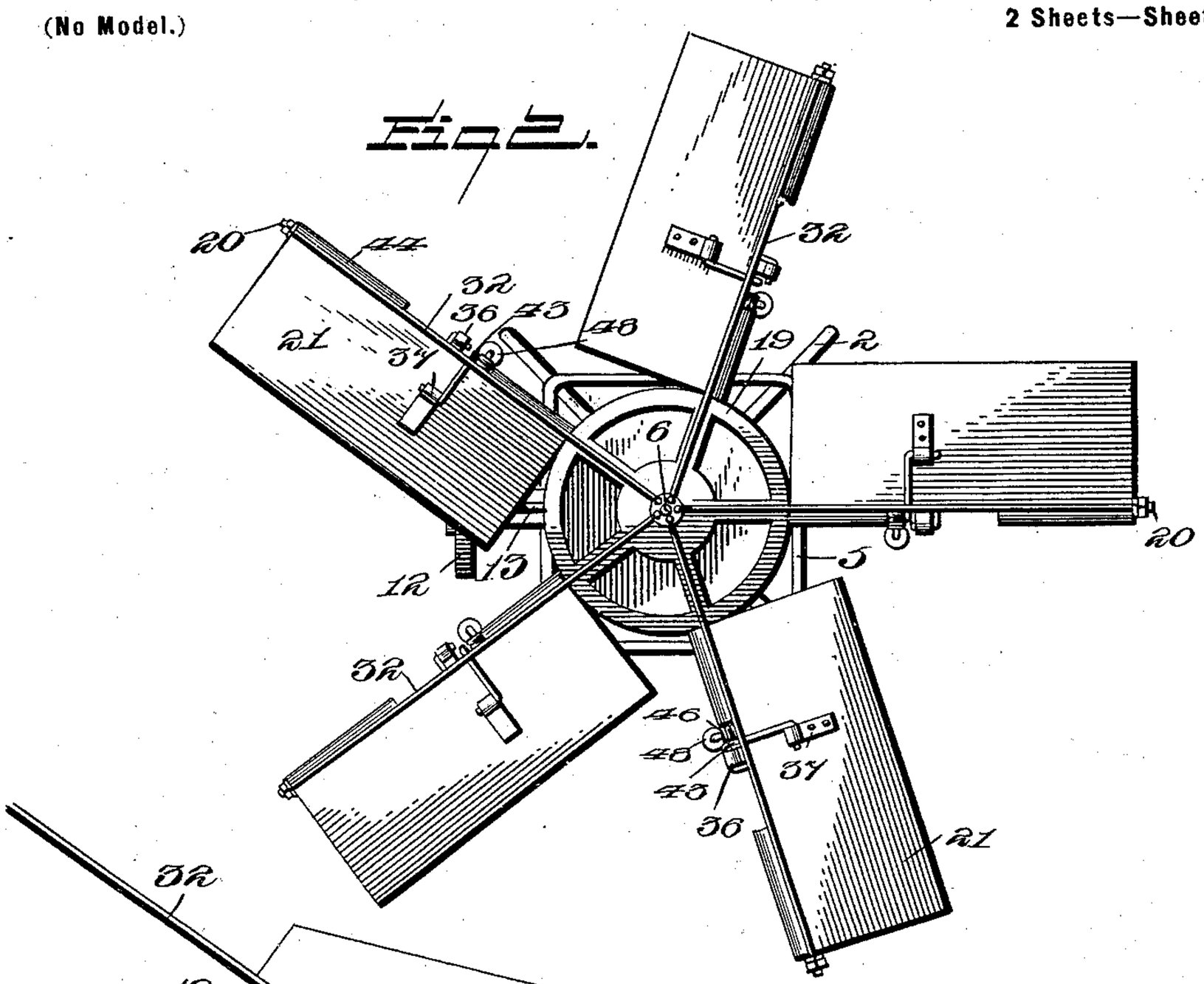
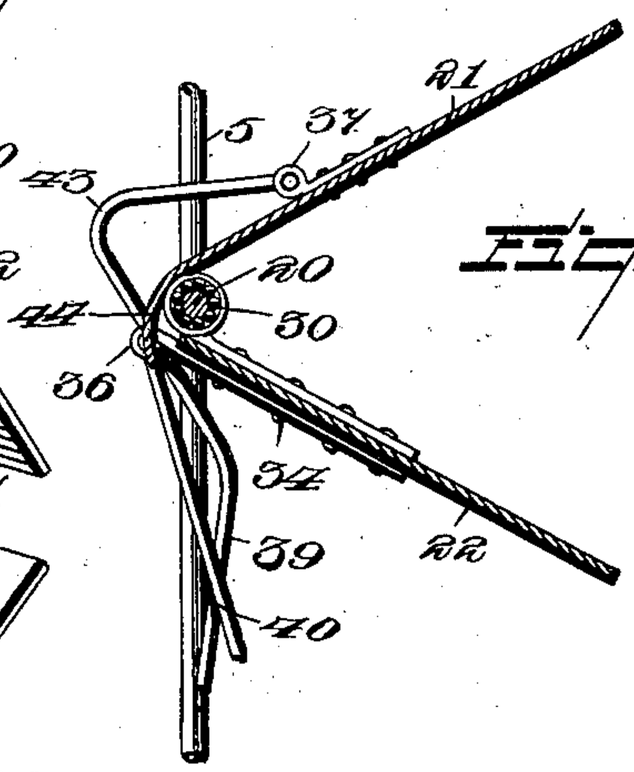


Fig. 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

FRANKLIN L. FETTY, OF MOUNT HOPE, KANSAS.

WINDMILL.

SPECIFICATION forming part of Letters Patent No. 665,891, dated January 15, 1901.

Application filed May 31, 1900. Serial No. 18,596. (No model.)

To all whom it may concern:

Be it known that I, FRANKLIN L. FETTY, a citizen of the United States, residing at Mount Hope, in the county of Sedgwick and State of Kansas, have invented a new and useful Windmill, of which the following is a specification.

My present invention relates to improvements in windmills; and one object in view is to produce a mill which will automatically regulate its speed by throwing itself into or out of the wind in accordance with the violence with which the wind is blowing.

A further object is to construct a mill having a plurality of wind-wheels, each of which is made up of a series of wings having a balanced connection with the wings of the other wheels.

A still further object of the invention is to provide a simple device by means of which an operator located upon the ground or, more properly, at the base of the tower may throw the windmill out of the wind by urging the several wings into their horizontal position when it is desired to discontinue the use of the apparatus.

To the accomplishment of these several ends and others subordinate thereto the invention consists in the construction and arrangement hereinafter described, illustrated in the accompanying drawings, and succinctly defined in the appended claims.

In said drawings, Figure 1 is an elevation of my windmill complete. Fig. 2 is a top plan view thereof. Fig. 3 is a detail perspective view of the corresponding wings of the upper and lower wheel, illustrating the balancing connection and the construction of the governor. Fig. 4 is an enlarged sectional view through one of the wings. Fig. 5 is an elevation illustrating the manually-operated stopping device for throwing the windmill entirely out of the wind.

Referring to the numerals of reference indicating corresponding parts and structural peculiarities throughout the several views, 1 indicates a windmill-tower comprising a number of standards 2 and a head-disk 3. At a suitable distance below the disk 3 is located a horizontal bearing-plate 4, supported by horizontal braces 5, which serve to stiffen the tower and to rigidly retain the bearing-plate 4 and its connected parts in their proper relative positions. The disk 3 and plate 4 constitute supports for antifrictional ball-bearings 3^a and 4^a for the vertical mill-shaft 6, provided above the disk with suitable wind-wheels and immediately below the plate 4 with a crank-wheel 7, to which is eccentrically connected one end of a pitman 8, having a pivotal connection at its opposite extremity with a bell-crank pump-lever 9, fulcrumed at the lower end of the pendent bearing-bracket 10 and operatively connected to the pump-rod 11 in the usual manner. For the purpose of balancing the movement of the shaft 6 I preferably provide a fly or balancing wheel 12, keyed or otherwise secured upon a shaft 13, journaled in suitable bearing-brackets 14, carried by the plate 4, and having upon its extremity opposite the wheel 12 a beveled pinion 15, meshing with a beveled gear-wheel 16, keyed upon the shaft 6 a suitable distance above the plate.

Instead of employing a single wind-wheel at the upper end of the mill-shaft 6 I prefer to employ duplicate upper and lower wind-wheels 17 and 18, each comprising a hub 19 and a series of radial arms or spokes 20, secured to the hubs in any suitable manner. The arms or spokes 20 of each wheel 17 and 18 are located one above the other—that is to say, the arms 20 of the wheel 18 are located directly under the arms of the wheel 17. Upon each of the several arms 20 are mounted a pair of wing-plates, those of the wheel 17 being numbered 21 and 22 and those of the wheel 18 being numbered 23 and 24. The pair of wing-plates carried by each spoke constitutes a wing, and as I shall hereinafter refer to the "opening" and "closing" of the wings it may be proper to state that by this is meant such relative movement of the wing-plates as will present them before the wind or will cause them to lie in horizontal planes with their edges opposed to the air-currents. The wing-plates of each wing are pivotally connected at one edge to a spoke by means of hinges 25 and 26, the securing-plates 27 of which extend a sufficient distance over the face of the plate to stiffen and brace it transversely, and between these securing-plates 27 and preferably adjacent to the hinged edge of the plate is disposed a longitudinal stiffen-

ing and brace plate 28, which also serves to weight the plate, more or less, at a point adjacent to its hinge-mounting. For the purpose of preventing the plates from binding by reason of their tendency to slide outwardly on the spokes under the action of centrifugal force when the wheel is rotating at a high rate of speed each spoke is preferably provided with a cylindrical boxing or sleeve 29 adjacent to its outer extremity and against which the adjacent hinge 25 has an antifriction-bearing—as, for instance, by the interposition of antifriction-balls 30. 31 indicates vertical stays connecting the outer ends of vertically-alined spokes for the purpose of stiffening the duplex wheel structure and in order to insure the maintenance of the relatively-fixed positions of the upper and lower wheels 17 and 18, and, if desired, tie or brace rods 32 may be connected at their inner ends to the shaft and at their outer extremities to the outer ends of the spokes 20 of the upper wheel. It will now be seen that the wind blowing between the disconnected edges of the plates of each wing will open the wing to present a maximum area of effective surface to receive the impact of the wind and effect the rotation of the mill. Some means must be provided, however, for insuring the identical operation of the corresponding wings of the upper and lower wheels, and by reference more particularly to Figs. 3 and 4 of the drawings the particular mechanism which I employ for this purpose and for the purpose of balancing and governing the movements of the wing-blades will be seen. The lower plates 22 and 24 are provided on their under faces with arms 33 and 34, which extend beyond the hinged edges of the plates and are provided at their extremities with bearing sockets or sleeves 35 and 36.

The upper plates 21 and 23 are provided with bearing-sockets 37 and 38 similar to the sockets 35 and 36, except that they are located within and not beyond the hinged edge of the plates to which they are attached—that is to say, the sockets 37 and 38 are located upon the upper surface of the plates 21 and 23, while the other sockets 35 and 36 are on the contrary located beyond the hinged edges of the plates 22 and 24. Now in order that the plates of vertically-alined wings will have identical movement and will balance each other it is necessary that the plates 21 and 24—that is to say, the upper plates of the upper wheel 17 and the lower plates of the lower wheel—be connected in a manner to permit and, in fact, to compel their opposite movement, so that the weight of each plate will counterbalance the weight of the other. It is also necessary that such connection and relative movement be established between the plates 22 and 23. I therefore provide a pair of connecting-rods 39 and 40, having a relative pivotal movement upon a horizontal axis intermediate of their ends. This pivotal connection I preferably effect by providing a horizontal bearing-sleeve 41 upon the connector 39, within which is designed to bear a horizontal fulcrum-stud 42, projecting from the connecting-rod 40. The connecting-rod 39 has its opposite extremities bent at right angles for pivotal engagement with the sockets 37 and 35, carried by the plates 21 and 24, and adjacent to its upper end is bent or offset, as indicated at 43, to permit it to extend around and over the hinged edge of the plate 21 for connection with the socket 37. In like manner the opposite extremities of the connecting-rod 40 are disposed angularly for engagement with the sockets 36 and 38 of the plates 22 and 23. It will now appear that as the plate 21 is swung upwardly from its horizontal position the connecting-rod 39 will be elevated longitudinally, which by reason of its connection to the outer end of the arm 33 will cause the plate 24 to be swung downwardly. In like manner the downward swinging of the plate 22 when the upper wing is forced open will effect the elevation of the rod 40 and will raise the wing-plate 23 in corresponding degree. In fine, the opening or closing of the plates of either wing will effect identical movement of the plates of the corresponding wing of the other wheel by reason of the fact that each plate is connected to and balanced by that plate of the adjacent wheel which has a movement opposite to its own during the closing or opening of the wings. Any suitable means for limiting the relative movement of the wing-plates may be provided; but I prefer to form longitudinally-disposed and transversely-curved stop-flanges 44 at the hinged edges of the plates 21 and 23 and arranged to impinge against the plates 22 and 24 when the wings are swung to their open positions, as illustrated in Fig. 3 of the drawings.

The mill as thus far described constitutes a complete embodiment of my invention in its broadest aspect, since it comprehends a mill having a plurality of wind-wheels, the wing-plates of which are balanced for the purpose of rendering them extremely sensitive; but while this sensitive mounting of the wing-plates is desirable, for the reason that it insures prompt opening of the wings as they move into the path of the wind and their prompt closing as they move out of such path, still this peculiarity makes it all the more necessary to provide an automatic governing device which will permit the wings to open a sufficient distance only to insure the effective operation of the apparatus. Otherwise the unrestricted opening of the wings would present to the wind an effective area which would be sufficient with the wind blowing violently to cause the rotation of the mill at a speed which would endanger the integrity of its parts and connections. For this reason I pursue the development of the apparatus somewhat further by providing an automatic governor for each connected pair of wings. These governors are in the form of levers 45,

having horizontal fulcrums 46, located, preferably, in about the horizontal plane of the lower spokes 20 and are provided at their upper and lower extremities with an angularly-disposed notched tailpiece 47 and a weight 48. Now in order that the action of the governor may be clearly understood it should be borne in mind that the opening of the wings necessitates longitudinal movement of the connecting-rod 39 and that therefore if we retain the connecting-rod against movement in any given position of the wings we will prevent further separation of the wing-plates and will prevent the opposing of a greater effective area to the action of the wind than has been produced by such separation of the wings as may have taken place before the stopping of the longitudinal movement of the connecting-rod 39. I therefore extend what may be termed a "projection" or "stud" 49 from the connecting-rod 39 and located in the path of movement of the notched tailpiece 47 of the governor, the stud 49 being preferably provided with an antifriction thimble or roller 50 to facilitate a coöperative contact between the stud and the tailpiece without producing undue wear upon either element. Any suitable means for supporting the fulcrum of the governor-lever may be provided; but this fulcrum is preferably obtained by bending at right angles the outer end of a governor-supporting arm 51, extending radially from the hub 19 of the lower wheel immediately above each of the spokes. It will now be seen that as the wheels rotate under the action of the wind the weights 48, urged outwardly by centrifugal force, (which will of course vary in accordance with the speed of rotation,) will swing the governor-levers upon their fulcrums and will cause the engagement of the tailpieces 47 with the studs 49 to prevent further opening of the wings, and obviously this engagement will be effected sooner or later, as the case may be, in accordance with the violence with which the weight 48 is swung outwardly—that is to say, if the wind is not violent and the speed of the wind-wheel is low then the governor-weights will not be thrown outwardly by the centrifugal force, and consequently the governors will not interfere with the unlimited opening of the wings. Supposing, on the contrary, that the wind is violent, the speed of the wheel will be so great that the governor will be operated to check the movement of the connecting-rod 39 before the wings have opened a sufficient distance to present too great an effective area to the wind. It being understood that the tailpieces 47 are provided with a series of notches, it will be seen that a wide range of automatic adjustment is obtained in order to regulate the extent of separation of the wing-plates under the varying conditions of use.

Another feature of my invention resides in a novel form of apparatus for effectually throwing the mill out of operation by hand. This manually-operated device comprises a wing-closing rim 52, slidably mounted upon the shaft 6, above the head-disk 3, and designed to be raised against the under side of the wheel 18 to close the wings by means of a reciprocatory rim-actuator 53, having bearings in the disk 3 and plate 4 and operated by means of a cable 54, connected at one end to the actuator 53, passed over a pulley 55, located just under the head-disk 3, and having its opposite extremity connected to what may be termed a "wing-closing lever" 56, pivoted at a convenient point upon the tower and designed to be retained by a rack 57. By swinging the lever 56 the wing-closing rim 52 may be elevated to close the wings wholly or to any desired extent, and this feature of the invention therefore comprehends a manually-operative mechanism for regulating the opening of the wings.

From the foregoing it will be observed that I have invented a simple, inexpensive, and highly-efficient windmill equipped with automatic governors and a manually-operated device for opening the wings and embodying, further, a plurality of wind-wheels having wing-plates balanced by each other; but while the present embodiment of my invention appears at this time to be preferable I do not desire to limit myself to the structural details defined, as I may wish to effect such changes, modifications, and variations as fall properly within the scope of the protection prayed.

What I claim is—

1. A wind-wheel comprising upper and lower wings, each wing being composed of a pair of wing-plates movable into and out of the wind, and means interdependently connecting each wing-plate of each wing with a plate of the other wing to effect identical movement of corresponding plates of the upper and lower wings.

2. A wind-wheel comprising upper and lower wings each composed of a pair of wing-plates movable into and out of the wind, and means for connecting each wing-plate to a wing-plate of the other wing in a manner to compel corresponding movements of the connected wing-plates but in opposite directions.

3. A wind-wheel comprising upper and lower wings each composed of a pair of wing-plates movable into and out of the wind, and a pair of connected rods each connecting a plate of the lower wing with a plate of the upper wing to compel the identical operation of said wings.

4. A wind-wheel comprehending a pair of relatively-movable wing-plates, a longitudinally-movable connecting-rod intermediate of said plates, and a weighted governor-lever operatively related to but normally disconnected from the connecting-rod and designed to be operated by centrifugal force to arrest the longitudinal movement of the connecting-rod and thereby govern the movement of the wing-plates.

5. A wind-wheel comprising upper and lower wings each composed of a pair of wing-

plates, connected rods each connecting a plate of one wing with a plate of the other, a stud extending from one of said rods, and a weighted governor-lever provided with a notched tailpiece designed to engage the stud to arrest the longitudinal movements of the connecting-rods and thereby regulate the relative movement of the wing-plates.

6. A complex wind-wheel comprising upper and lower wheels carrying upper and lower wings, each wing being composed of a pair of hinged wing-plates, arms extending from the lower wing-plate of each wing, a connecting-rod pivotally connected to each of said arms and to the upper plate of the other wing, whereby the connected plates of each wing are compelled to move in opposite directions, means for connecting said connecting-rods to insure their corresponding longitudinal movement, a stud projecting from one of said rods, and a weighted governor-lever provided with a notched tailpiece in angular relation to the lever and arranged for engagement with said stud to limit the longitudinal movement of the connecting-rods and thereby regulate the opening of the wings.

7. A wind-wheel comprising upper and lower wings, each wing being composed of a pair of wing-plates movable into and out of the wind, means interdependently connecting each wing-plate of each wing with a plate of the other wing, and means for limiting the relative movement of said plates.

8. A windmill comprising upper and lower wings each composed of a pair of wing-plates movable into and out of the wind, each plate of each wing having an interdependent connection with a plate of the other wing, and a governor controlling the positions of said plates.

9. A windmill comprising upper and lower wings each composed of a pair of wing-plates, each plate of each wing having an interdependent connection with a plate of the other wing, a governor operated by centrifugal force to control the positions of said plates, and manually-operated means for regulating the opening of the wings and for effecting their complete closure to throw the wheel out of the wind.

10. A windmill comprising upper and lower wings each composed of a pair of wing-plates, each plate of each wing having an interdependent connection with a plate of the other wing, a wing-actuating rim shiftably mounted below the wheel, and means for elevating said rim into engagement with the bottom plates of the lower wings to effect the regulation of the several plates of both wings.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

FRANKLIN L. FETTY.

Witnesses:
SCOTT MCCORMICK,
F. C. JORGENSEN.